WE CLAIM:

1. A hyperbranched polymer comprising:

an inner core, comprising a network of covalently bound molecular chains including heteroatoms, wherein at least one of the chains comprises at least one moiety that includes two heteroatoms spaced apart by at least two atoms; and

an outer shell comprising active hydrogen-containing groups covalently bound to an outer portion of the core.

2. The hyperbranched polymer of claim 1, wherein the heteroatoms are selected from the group consisting of oxygen atoms, sulphur atoms, nitrogen atoms, and mixtures thereof.

3. The hyperbranched polymer of claim 1, wherein the active hydrogen containing groups are selected from the group consisting of hydroxyl groups, thiol groups, primary amine groups, secondary amine groups, and mixtures thereof.

4. A hyperbranched polymer of claim 1, wherein the bound molecular chains comprise ether linkages, the two heteroatoms are each oxygen atoms, the two oxygen atoms are spaced apart by at least four atoms, and wherein the hydrogen-containing groups are hydroxyl groups.

5. The hyperbranched polymer of claim 4, wherein the hyperbranched polymer is formed by a reaction of a first component including at least two epoxide groups and a second component including at least two hydroxyl groups, together with an electrophile.

6. The hyperbranched polymer of claim 1 or 4, wherein the at least four atoms are each carbon atoms.

7. The hyperbranched polymer of any one of claims 4 to 6, wherein the one or more moieties each comprise $-O(CH_2)_nO-$, where n is an integer from 2 to 12, and wherein n can be the same or different in each moiety compared to each other moiety.

8. The hyperbranched polymer of any of the above claims, wherein a number average molecular weight, measured against monodisperse standards of polyethylene glycol (PEG), is from about 5,000 Daltons to about to about 500,000 Daltons.

9. The hyperbranched polymer of any of the above claims, wherein a hydrodynamic diameter of the hyperbranched polymer, measured in water, is from about 15 to about 2000 nm.

10. The hyperbranched polymer of any of the above claims, wherein a total number of hydrogen-containing groups or hydroxyl groups is from about 75 to about 1000.

11. The hyperbranched polymer of any of the above claims, wherein at least portions of the outer shell are functionalized with an activated component.

12. The hyperbranched polymer of claim 11, further comprising a polymer grafted onto a portion of the activated component.

13. An adduct comprising any one or more of the hyperbranched polymers of any of the above claims and at least a portion of a nucleic acid, a therapeutic agent, or an imaging agent.

14. A method of making a hyperbranched polymer, the method comprising:
obtaining a first component comprising at least one epoxide group;
obtaining a second component comprising at least one active hydrogen group; and
reacting the first component with the second component in the presence of an electrophilic initiator for a time and under conditions sufficient to produce a hyperbranched polymer, wherein at least one of the first or second components has a total polymerizable functionality of 3 or greater.

15. A method of claim 14, wherein the total number of epoxide groups plus the total number of active hydrogen groups is four or greater.

16. The method of claim 14, wherein the first component comprises at least two epoxide groups; and wherein the second component comprises at least two active hydrogen groups.

17. The method of any one of claims 14 to 16, wherein a ratio of the first component to the second component is less than about 1.

18. The method of any one of claim 14 to 17, wherein the one or more active hydrogen groups each comprises a hydroxyl group.

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19. The method of any one of claims 14 to 18, wherein the second component comprises four hydroxyl groups.

20. The method of any one of claims 14 to 19, wherein the first component is a small molecule with a molecular weight of less than 750 Daltons.

21. The method of any one of claims 14 to 20, wherein the second component is a small molecule with a molecular weight of less than 750 Daltons.

20 22. The method of any one of claims 14 to 21, wherein the first component is selected from the group consisting of glycidol, ethylene glycol diglycidyl ether, glycerol diglycidyl ether, glycerol triglycidyl ether, tetraglycidyl pentaerythritol, polyethylene glycol diglycidyl ether, glycerol polyethylene glycol triglycidyl ether, tetraglycidyl polyethylene glycol erythritol, and mixtures thereof.

23. The method of any one of claims 14 to 22, wherein the second component is selected from the group consisting of glycerol, erythritol, pentaerythritol, polycaprolactone triol, glycerol ethoxylate triol, pentaerithrytol ethoxylate, and mixtures thereof.

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24. The method of any one of claims 14, wherein the second component is $(R_4CH_2)(R_3CH_2)(R_2CH_2)(R_1CH_2)C$, and wherein R_1 to R_4 each comprises $(ACH_2CH_2)_nAH$, wherein A is oxygen or sulphur, and n is greater than or equal to 1 to about 10,000.

25. The method of any one of claims 14 to 24, wherein the conditions comprise employing a diluent.

26. The method of claim 25, wherein the diluent comprises a halogenated diluent.

27. The method of claim 26, wherein the halogenated diluent is methylene chloride.

28. The method of claim 25, wherein the diluent comprises a cyclic ether.

29. The method of claim 28, wherein the cyclic ether is tetrahydrofuran.

30. The method of any one of claims 14 to 29, wherein the conditions comprise maintaining a reaction temperature of less than 10 °C.

31. The method of any one of claims 14 to 30, wherein the electrophilic agent is employed at a concentration from about 0.001 to about 0.1 mole/L.

32. The method of any one of claims 14 to 31, wherein the electrophilic agent is a Lewis acid.

33. The method of claim 32, wherein the Lewis acid is selected from the group consisting of boron trifluoride, tin chloride, and mixtures thereof.

34. The method of claim 33, wherein the Lewis acid is boron trifluoride etherate.

35. The method of any one of claims 14 to 34, further comprising quenching the reaction to halt polymerization.

36. The method of any one of claims 14 to 35, further comprising activating at least some active hydrogen groups of a resulting hyperbranched polymer by reacting the resulting hyperbranched polymer with an activating component.